

2  
4.6  
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85  
59  
8

95 35  
60

4500  
350  
4150

253  
155  
408  
35  
443

212'  
163  
5  
5  
10  
395

P 501

5050  
5050

Glass Mtns.  
1958

Walter  
P 35

Neal Ranch  
P. 35

212  
44  
148

7100

218

Ⓢ



N side Decie Hills	1,
Sullivan Peak	3, 4, 7, 31
Windmill Hill	5, 22, 33
East of Sullivan Peak	8
Leonard Mtn.	9, 17, 21
Hess Ranch	13,
Hill W. of Crown Mtn.	26
Clay slide	32
Wolfcamp hills	34, 42
Hill east of Wolf-Camp	40
Fossil bed	45, 46
Word 4 Hess Canyon	48
Hill NW of Hess R.	49.
Hess Ranch Horst	46

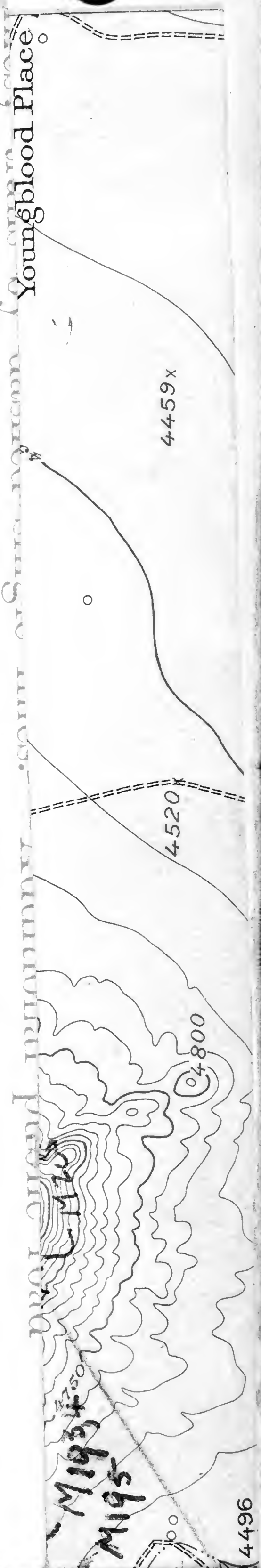


0486

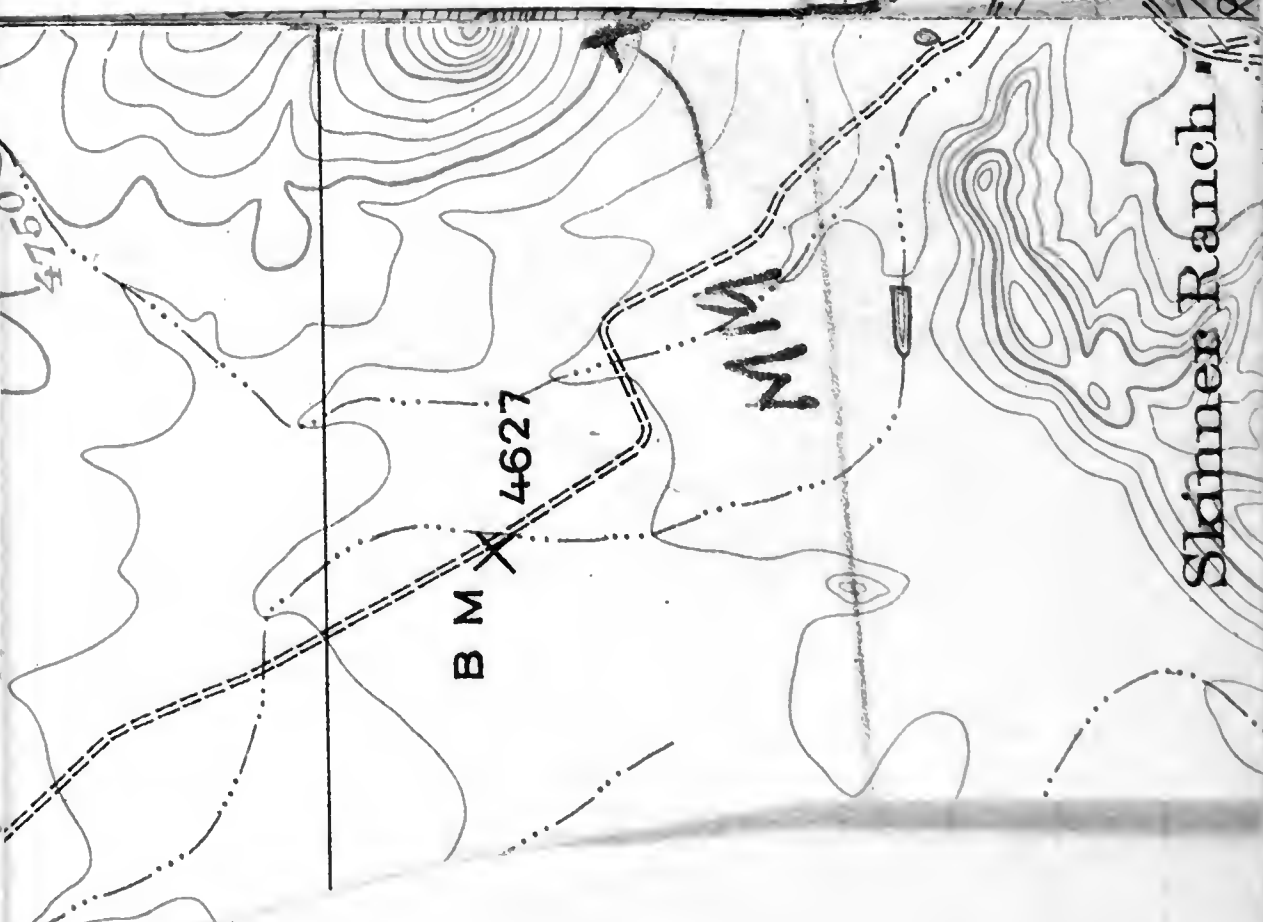
classification if available is shown by red overprint.

Each quadrangle is designated by the name of a city, town, or prominent natural feature within it, and on the margins of the map are printed the names of adjoining quadrangles of which maps have been published. More than 4,100 quadrangles in the United States have been surveyed, and maps of them similar to the one on the other side of this sheet have been published.

Geologic maps of some of the areas shown on the topographic maps have been published in the form of folios. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped, and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. Two hundred twenty-five folios have been published.



Skinner Ranch



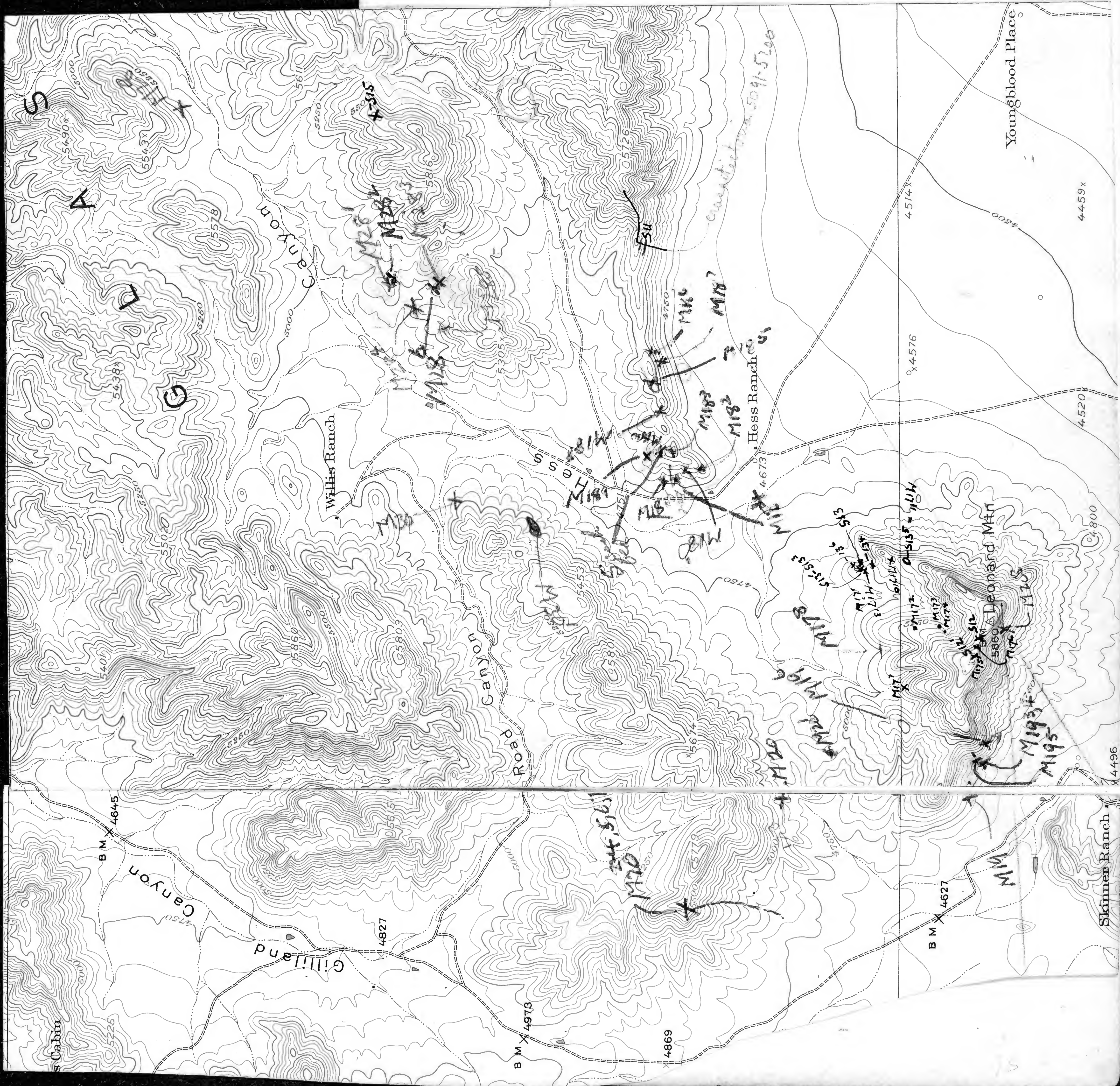
Scale of  $\frac{1}{31,680}$  (1 in

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2. Surveys of public important and its tributaries the publication (mile), with a contour

3. Surveys of public important region of Arizona of the northwest the publication (miles) or  $\frac{1}{250,000}$  (1 in







Wm

Wm

Wm

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4650  
5400

5760  
180  
5580  
4750  
890  
5640



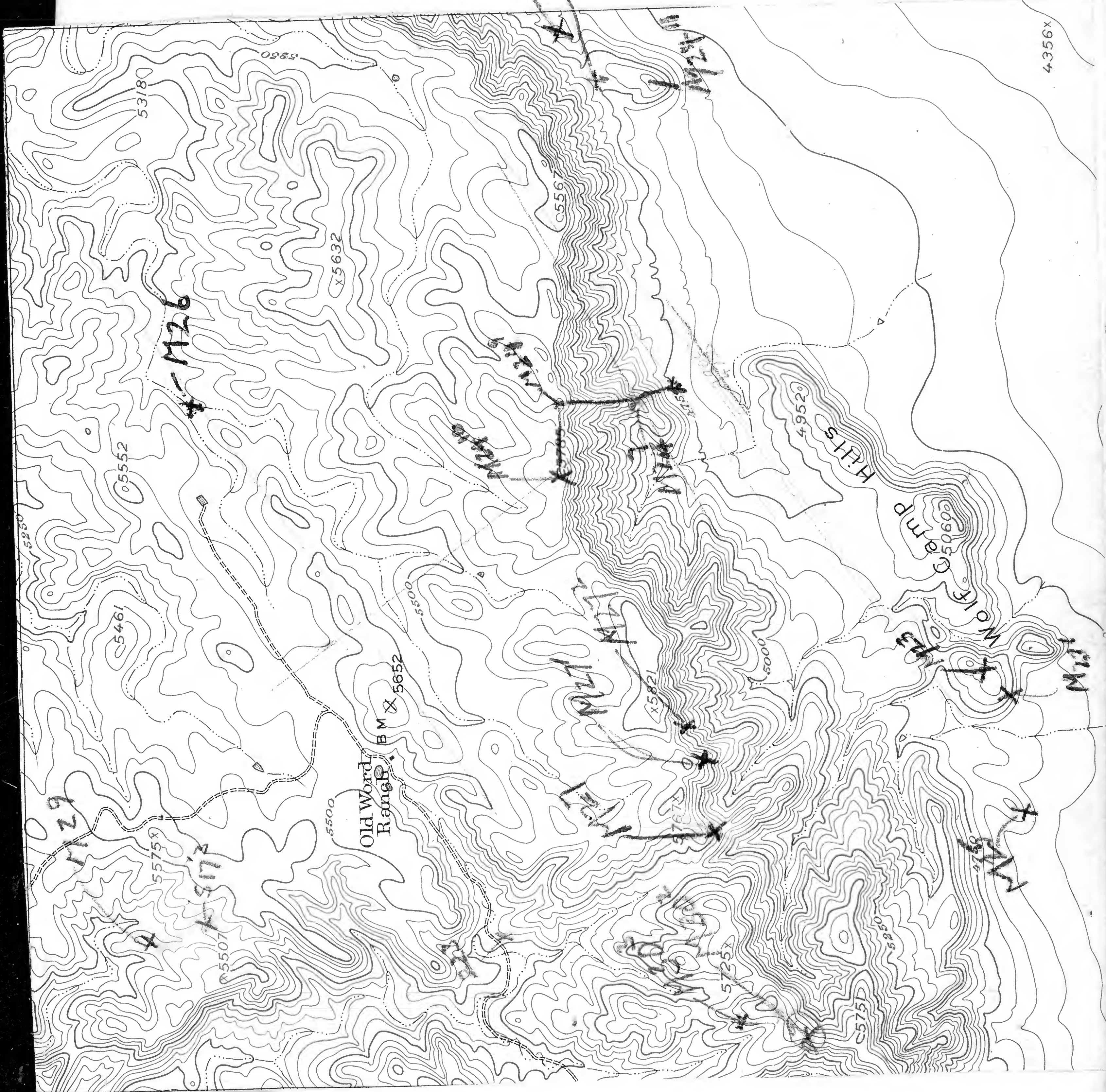


100

The manner in which contour lines express altitude, form.



0487



4356x



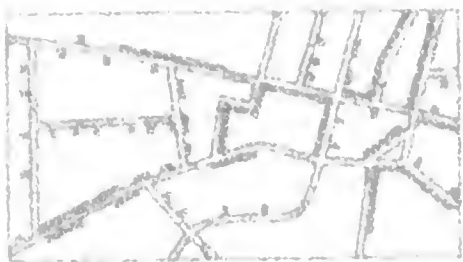
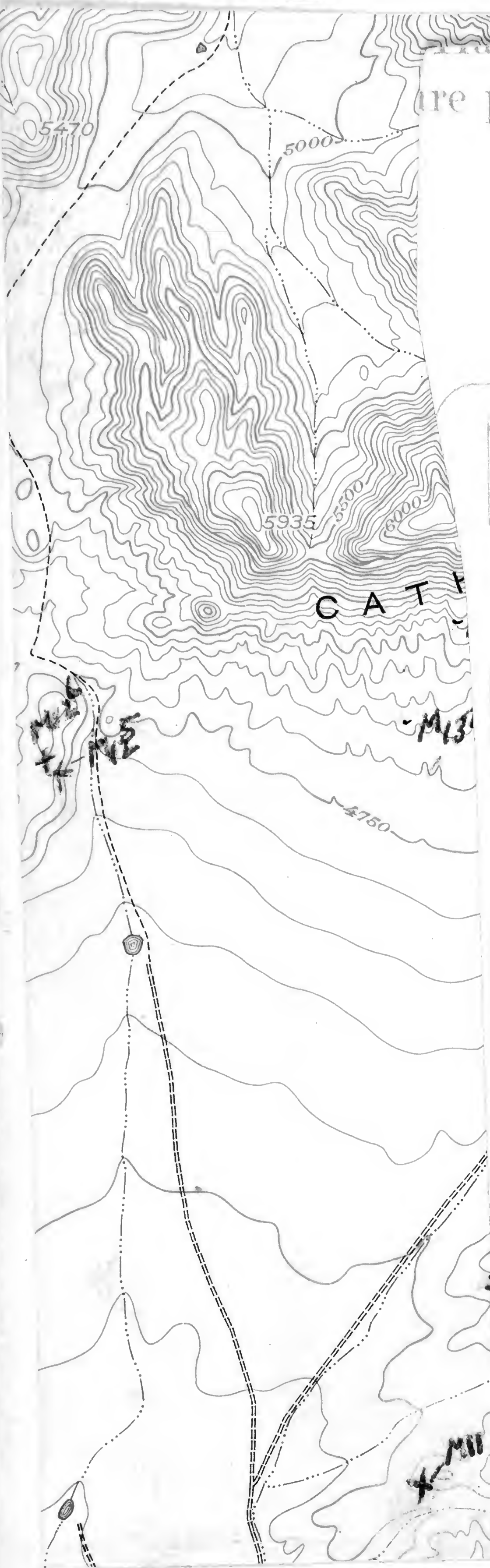
12  
11  
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18  
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96

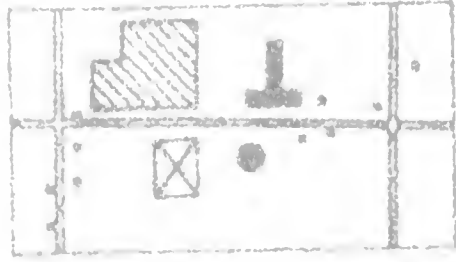
Black Pit.



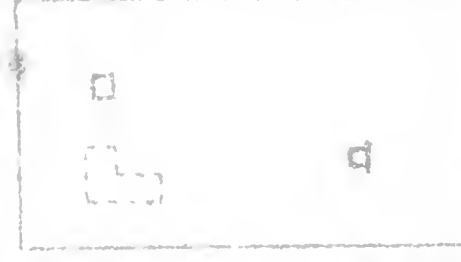
Marshall Islands have been surveyed, and the maps are published on a scale of  $\frac{1}{62,500}$ .



City or village



Roads and buildings

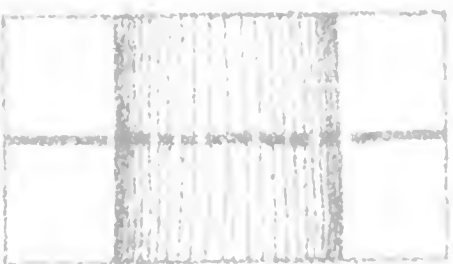


Ruins

Cliff dwelling



Good road



Ford



Dam Dam with lock



Canal (point of view)

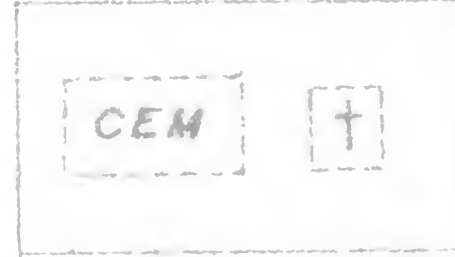


Boundary monument



Bench mark

(supplementary bench mark shown by cross and black figures without lettering)



Cemeteries



Church (distance recorded)

### RELIEF

(printed in brown)



Elevation above mean sea level (in black on recent maps)



Contours

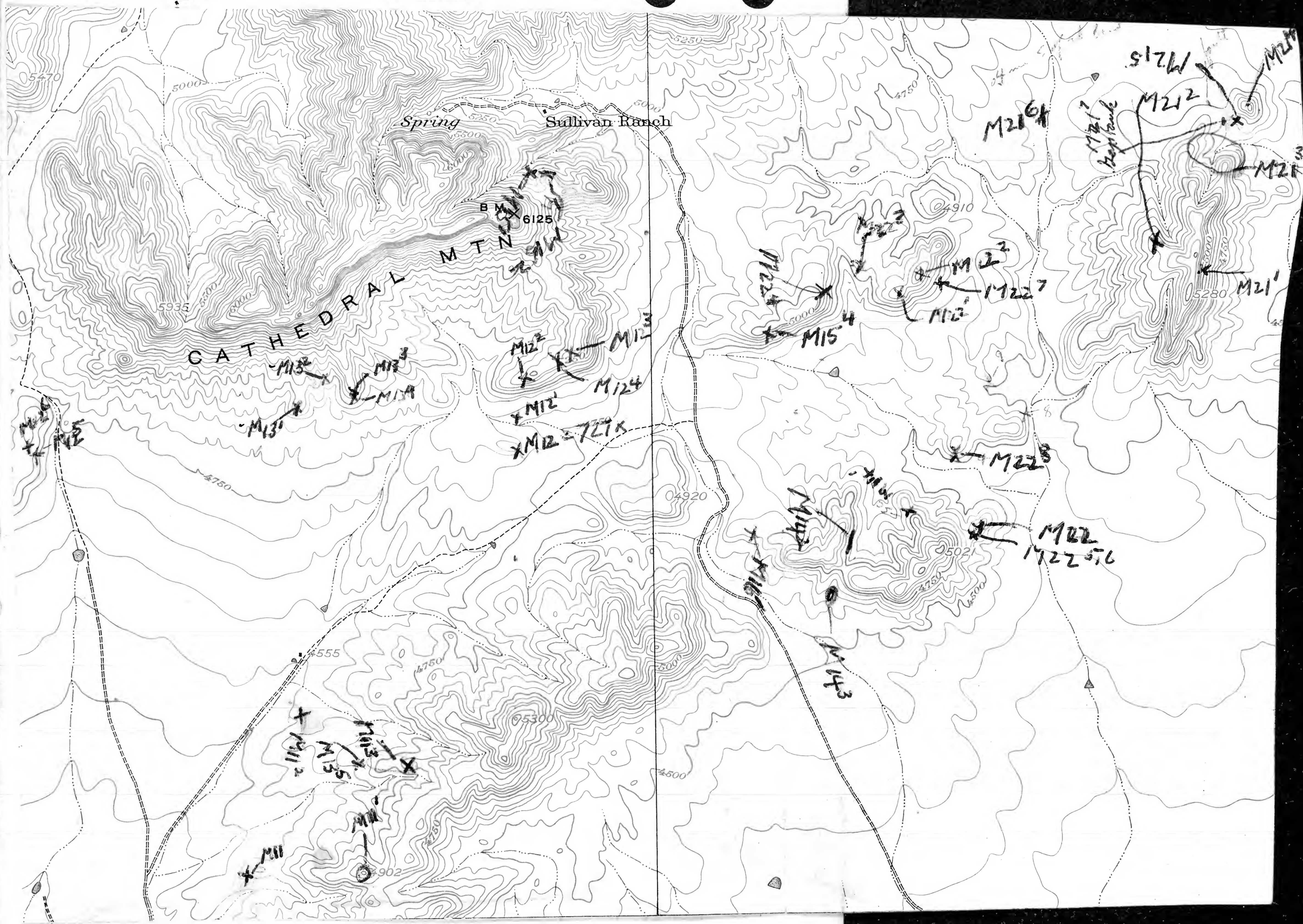
(Contours showing depth of water printed in blue)



Depressed contour



0488





n

n

35  
165  
179

n

n

12  
101  
11  
130

332  
8  
412

366



①

May 11

714W M11 - Locality in Leonard 2 with *Orthis*ella. Characteristic smooth ls. surrounded by calcarenite. Locality is  $515^{\circ}$  W of knot with elevation 4700' and  $522^{\circ}$  W of knot with elevation 4801.

710b M11' Came up hill 4902 on south side along canyon slope. Contains bihermal limestone overlain by coarsely granular and conglomeratic ls. *Orthis*ella is the commonest fossil. Saw *Orthis*ella and *Protolothotrichia*. Fossils not very common and biherms with much irregular silicified material probably algae or bryozoan. Sharp knot is  $534^{\circ}$  W of this knot.

710c M11<sup>2</sup> - a few feet of dark granular ls. overlain by 6" to one foot of light brown sandstone. This is Leonard ls. 3 of P.B.K.

710d M11<sup>3</sup> Leonard ls #2 forming knob and long dip slope west of it. Limestone about 8-12' thick, with upper part of a light gray weathering, granular ls. sand on top of the hill is dolomitic. The lower part of the ls. has the knobby blue, smooth limestone with *Orthis*ella and occasional *Orthis*ella. The bihermal material is not as strongly developed as that on the knobs to the SW where the blocks were taken.

Look three blocks from M11 = 714 W check *Orthis*ella beds.



(2)

136.5 Splinter  
134.7 - Intersection  
134.1

0490

May 12

Section on knob (SE end) 1.5 miles S of Sullivan Peak

On back slope about 50' below top of this ss hill an *Aridanthus*-like productid, such as one seen in the Clay slide.

M12 = *Ammonoidea* from base of section

About 5100' elevation, about halfway up hill M12 cone Bioherms in Leonard, massive with *Aulosteges* and suggestive of those at Word Ranch. Above cone shaly ls + thin shales of Word #1 Type.

Top of hill

40'

conglomerate + sandstone. An occasional fossil in limy band. Sandstone (sugary) predominant

27'

Fine grained yellow to brown ss making a conspicuous ledge

5'

quartz pebble sandy congl.

25'

covered possibly shale

30'

mostly congl, crumbly with occasional limy band. About 2' hard ss near base, most of section sandy.

1'

Dark bituminous ls. with goniatites

15'

Clay shale from base of hill



4900  
120  

---

5020



③

M12' platy ss in small gully.

On west nose of hill south of Sullivan Peak, Leonard-like ss and conglomerate go up to about 4950' on the hillside. At about 5020' thin-bedded shaly rock appears between beds of hard smooth limestone. Thick-bedded chert appears at 5020.

M12<sup>2</sup> First fossils seen in coming up through Lower Word, a convex domatid with deep sulcus about 30' below blow small knot 5250'

M12<sup>3</sup> about 10' below top of west side hill south of Sullivan Peak about 5340'±

M12<sup>4</sup> about 5260' on west slope from top of hill south of Sullivan Peak

M12<sup>5,6</sup> Word exposed in long, low foothill. The matrix of the hill is mostly thin platy, yellow "shale" containing layers and bands of limestone. The limestones are often of detritus all fossils but fusulines badly broken. Most of the pieces are silicified. Top of hill of platy and cherty bituminous limestone like that of 7040. This however contained no fossils except fusulines. The locality is no good for silicified material.

Later walked bluff of Leonard 6 #1 southeast of hill 4801. Mostly a thick conglomerate at this place. Found no *Geyserella*.



Ad. ac. cat. Sc. Ex. Inf



④

M13

Went on SW slope Cathedral Mtn. on line of King's section 11. Visited his localities 53 & 54. Section up this knob is just like that seen at M12<sup>5,6</sup>. Many types of lithology from smooth platy, carbonaceous limestone to sandstone and thick layers of calcarenite. Fossils are abundant but generally confined to the coarse calcarenites and are always very badly broken or in little pieces. Fossils are abundant sample M13<sup>1</sup> was taken about 30' below the top of the knob.

From small knob we circled east across the two gullies. M13<sup>2</sup> was taken between gullies and about 50' higher than top of small knob.

The larger or easternmost knob is like the smaller one but with the exception that, at about the middle, is a layer of calcarenite about 20' thick which makes a prominent ledge in the hill.

Carbonaceous limestones occur on the crest of the knob in patches. They weather light gray or buff.

M13<sup>3</sup> is about 50' below top and M13<sup>4</sup> is 75-100' below top on a prominent bench.

Spent afternoon at M13<sup>5</sup> down slope from M11<sup>3</sup>. Here biohermal beds of Leonard #2 appear which contain *Orthis*. Also present are granular limestone beds with *Ammonites*, *Perrinites* and *Medlicottia*. Leonard 2 cannot be more than a few feet thick, changing in thickness from place to place. To east it thickens considerably and becomes strongly conglomeratic along slope where it ends.



⑤

May 14

Windmill hill. - Went below saddle in middle of hill again to look for fossils in cgl. below Hess ledge. Measured 60' of cgl. + ss. The cgl. near the Hess ledge is massive with small, angular, dark brown pebbles. Lower the rock is mostly fine-grained sand with scattered pebbles. Some sandy shale in between beds of cgl. especially near top.

Hess ledge here is about 40' thick.

M14<sup>1</sup> - Scacchiella in loose piece on saddle, actually practically in place.

M14<sup>2</sup> - We made a swing over the tops of the hills in windmill hill and returned by the west side of the valley separating the two sets of hills. Here near the top of Leonard #1 near bottom of valley (about 4700') smooth bluish ls. contain fossils that can be broken out. A new Stenoscisma (possibly Urcinuloides) was seen here.

M14<sup>3</sup> about 800 feet up stream in arroyo leading to saddle comes a short section of orange shales and thick-bedded ss. These appear to be in position between the Hess ledge and the Leonard ls #1, the top of which forms the saddle. A small productid like that from J18 was common.



⑥

Examined most of Windmill hill. Again saw no unequivocal Wolf-camp in it. The Wolfcamp mapped by King on the south of the hill appears to be Leonard as it has orange shale, heavy-bedded ls layers 1-1½ feet thick with silicious skin on top. This is well exposed in a gully heading into the saddle between the south tier of hills and the hill on the north.

From north side of hills we could see King's localities 4 and 8. These are almost certainly in the upper Hess = limestone #1, probably these inseparable from Hess ledge.

The Leonard ls. #1 is mostly a fine grained calcarenite, massive and showing little or no bedding. It contains conglomerates of many kinds and biohermal layers like those at Split Tank. It has a great variety of lithologies.

King's locality #4 with *Scaphinella* is most certainly in the upper Hess = Leonard ls. #1, and looks to be continuous with the beds forming the top of Windmill Hill.

We found *Unicrinuloides* in the upper part of the ~~upper part~~ the Leonard #1 limestone. One specimen was taken from the saddle between the north & south hills and several from the south slope of the north hill in the upper part of ls #1. I did not see anything I would call *Strophomena* anywhere in ls #1 of the Leonard, although King reports it.



⑦

May 15

Spent morning on hill one mile S of Sullivan Peak.

(NE)

M15<sup>1</sup> = 717hM15<sup>2</sup> =

710t

M15<sup>1</sup> + 2. - low hills under Sullivan peak have an extension of the bituminous Word 1. The platy bituminous rock appears in the lower slopes but two thick ledges of calcarenite & congl about 30'-40' apart from the top. In the lower ledge we saw numerous *Coscinophora* which places those of 709c definitely in the lower Word. No fossils in the bituminous beds. *Fusulines* abundant in upper thick bed = M15<sup>2</sup>.

east of  
Sullivan  
road road

Walked over hill with elevation 5000'. lower Word is overlying the clay shale. Rock is massive without bedding, mostly calcarenite but is congl. the pebbles showing as shadows on the surface are with silicified ones. The rock is in places brecciated. *Coscinophora* is scattered but with it occur a small *richtropenid*, *Aulostegids* and a few other fossils like those in the last 709c block etched. This is certainly lower Word but the fauna unlike that of any other locality.

Pictures -

1. View looking north of hill just east of Sullivan Peak. M15<sup>4</sup>
2. *Coscinophora* block on slope of hill east of Sullivan Peak M15<sup>4</sup>



⑧

May 16

M16 - Spent morning on hill east of Sullivan peak collecting etc blocks of Lower Word. Megonaiid in float probably from lower Word but could be from Upper Leonard.

M16 - worked over slope of north end of Windmill hill on the rocks above Kings Leonard Is. #1. The rock on the slope is dark gray sandy limestone often with Perinella in abundance. Sponges are common with the ammonites. The limestone is in layers 4" to 9 or 12" in thickness, usually much jointed and fractured. The limestone layers often have a skin of chert on upper surface. Bioherms with sponges and Bryozoa appear in patches.

The blocks collected from M154 all contained Coscinophora. It is hard to see how any of the float on this hill could be from Leonard except near the top. Saw what looked like shale fragments in slope



<sup>7</sup>  
~~5400,~~  
 5350  


---

 450

187  
 20  


---

 200

64  
 5  


---

 320  
 27  


---

 347'

5250  
 4740  


---

 510



0497

May 17 Leonard Mtn

(9.)

Grease job at 21261

717j - M17<sup>1</sup> - Large exposure of *Scaevolinella* beds near base of hill and forming a small bench

717K - M17<sup>2</sup> - Bench on long hill rock is calcarenite with oily smell on fracture suggests Hess West. Occasional scattered pebbles. I guess this is downthrown side of fault. Found a loose *Spirifer*. Saw some yellow platy shale here.

717-L - M17<sup>3</sup> - *Scaevolinella* on hillside.  
Picture #3.

717m - M17<sup>4</sup> = 518 = *Leptodus* ledge. These *Leptodids* are about 15' above abundant *Scaevolinella*. This level is at about 5350' up slope S80° W of the *Leptodus* ledge.

0-9 hl above *Leptodus* = covered  
9-12 hl - massive fine grained dolomite making a prominent ledge  
S46° W 114° SE

12-16 HL same as above  
16-19 HL + 1' blocky ls in beds 6" to 1' thick dark gray, fine grained, small forams.

19-23 HL 1' covered

23-24 HL granular gray fine calcarenite  
24-36 HL Bottom 2 HL covered but above comes calcarenite somewhat massive and bedded giving way to ls congl. and bichermal type of ls, very massive and forming a ledge that is very prominent. It is the lowest ledge of the tier forming the top of the Mtn. It is capped by about 6" of hard brown sandstone



No 91 110585



(10)

36-48 Hk massive granular & ls  
congl. rocks.

At 48 Hk comes a massive bioherm with  
much silicified material, *Wellerella* and  
*Endolites*, *Neospirifer*, thick *richtofenids*,  
conical *Leptodonta*.

48-50 + 3' Hk = same massive type of rock  
On top of massive ledge comes yellow  
platy shale for about 3'

50-52 yellow shale

52-54 Hk - covered (probably shale)

54-64 Hk - all in massive granular  
and conglomeratic (sparsely, small pebbles)  
rock. This underlies one of the Leonard  
knobs. Top of Hess

64-76 Hk thin-bedded yellow shale  
and platy limestone about 6" to 1'  
Thick, the typical Leonard limestone,  
sandy, with broken shells and a  
thin skin of chert or ss on top.

7177- M175 walked to top of knob. Looking  
east to knob 5860 a big mass of  
Dolomite can be seen underlying the  
massive bed forming the top of the  
Hess. The entire knob M175 is composed  
of yellow shale and the typical  
blobby limestone of the Leonard.  
The knob composed of the 5730' contour  
is all dolomite but it butts into  
the saddle between it and knob 5860.  
A contrast in lithology appears there.  
The saddle is of limestone, light  
colored and contrasting strongly with  
dolomite of knob 5756'. This contrasting  
lithology, Dolomite against limestone  
must be King's fault.

264  
5  
3127  
343

Top of Knob  
788' from  
place where section  
ended.

76  
5  
350  
34  
A14  
427



64  
5  
326  
29  
347



(11)

7170-

M17<sup>6</sup> - This is about 40' above the saddle just west of 5860'. It is the big limestone forming the top of my section, but it is underlain by some 10 or 15' of yellow shale which forms the saddle and is in turn underlain by the thick bedded limestone forming the crest of 5860. This latter limestone underlies a thick dolomite. The 20' thick upper limestone holds up the westernmost knob. Although 10' of shale appears below this upper thick line this limestone is probably best assigned to the Hess.

Picture 4 - Leonard Mtn - dolomite peak and saddle - dolomite to limestone

717p-

M17<sup>7</sup> - Down slope to this point have been in Leonard shale and thin limestones. The top bed of the Hess, the bed underlying westernmost knob ends at about point M17<sup>7</sup> in a low bluff about 20 feet thick here it is underlain again by 15-20' feet of shale and then come massive limestones of the second tier of thick limestone.

The same situation exists in the hill to the east of M17<sup>7</sup>.

Upper is strongly egl. with small pebbles.

M17<sup>8</sup> - N70°W 11°N This was taken on beds of ~~ls~~ about 6" thick suggesting the beds low in the Hess above the *Saccharinella*. See small scale map.

Dip on isolated NE knob is 22° S60W.

This from  
S. M. M.  
dive



⑫

M17<sup>13</sup> = ~~M17<sup>8</sup>~~ - Large scale map = M17<sup>13</sup>  
 in saddle on S side of NE knot  
 and about 50' ground measure in heavy  
 bedded brecciated rock *Saccinella* occurs

717t

The unconformity of the Hess on Wolfcamp  
 is thus somewhat less than believed, at  
 any rate the *Saccinella* are not cut out  
 only the thinner beds between them  
 and the granular limestone on the beds

Strike N15°W 16°W about 50 yards  
 S of NE knot.

717g -

M179 northernmost knob of two  
 is massive limestone with *Lunella*  
 and what appear to be Wolfcamp  
 fusulines. The southernmost knob  
 is dolomite. This is a continuation  
 of the limestone with *Saccinella*  
 and may be basal Hess. The cgl. of the  
 WC is just 50' below the saddle between the knots.  
 Dip and strike on conglomerate  
 on south side of saddle:-

M17<sup>11</sup> - N-S 18°W; Dick made it N25E22°W

716y

M17<sup>12</sup> - Fusulines red, from very  
 top of knob. Conglomerate is  
 75' below top on North side of  
 knob and makes a long dip slope to  
 the valley.

The southern knob of the two  
 small ones is a dip slope of  
 dolomite, dipping 70° to the west.  
 A fault may occur at the dike  
 in the saddle. A great deal of  
 crystalline calcite is also suggestive



(13)

H. R. May 18

Get Geology Glass Mtns for

David Allam, Iron Mtn. Ranch.

Scacchiella beds N of Hess House overlie dolomite which form base of hill along road just S of Scacchiella. Dip on beach beds quite steep but may be draped over irregular Wolfcamp. I think the dolomite may be Wolfcamp.

With a  $10^\circ$  dip the beach bed just clear knot just N of Hess house and this would put the contact of WC + Hess at about contact of dol. & beach beds.

Walking S from beach beds to N slope of hill between draws. The beds become gradually more dolomitized and the rocks on the divide between the draws is massive dolomite.

The thinner bedded Hess, the calcarenite has very steep dips. The situation here is the same as on NE end of Leonard Mtn. Here draw  $N32^\circ E$  of the NE end of Leonard Mtn. approximately on a strike of basal Hess.

Just E of the Scacchiella beds which are in a hollow, is a knot of dolomite and the dolomite bed extends up to the east from the top of the hill. I think this massive bed is the one that caps the NE knob of Leonard Mtn. The massive dolomite forming the divide between the two draws seems to extend unbroken into the massive dolomite on the knob to the east. The beach beds are either lost in the dolomitization or they may pinch out between the WC and the more massive Hess. Saw an *Onycheloturbus* (large) near base (see margin)

of dolomite. Thought to be  
near base of Hess, about 110'  
above road.



717C-M18<sup>1</sup> partially dolomitized fusulines at base of Thick dolomite. I think these are Wolfcamp.

M18<sup>2</sup> - Fusulines just under dolomitized patch of ss and cgl. in saddle between dolomite knobs low on hill.

M18<sup>3</sup> came N.E. up spur of hill to first or westernmost high knob. One massive dolomite all the way. Saw only ghosts of crinoid stems + a doubtful *Cheloniceras*.

N45°E  
17°20' N

At top of knob rocks not greatly dolomitized. A few feet of bedded ls about 6" thick, to a foot thick, with granular or fossil hash.

Some thin beds with skin of silicious material. These beds look like the thin beds above Beach in Leonard Mtn.

Here on the very top of the knob are smooth blue bioluminal ls with *Spiriferophora*, big *Reticularia* + other fossils. These are on the E. side of the knob, where all is dolomite. The smooth blue ls produce a granular dolomite.

An amazing feature of the dolomitization here is the fact that patches of ls appear in it. The dolomite on this hill is clearly a facies type of Leonard has nothing to do with the East facies.

M18<sup>5</sup> passed abruptly from dolomite to limestone and from here east the rock is all limestone.

M18<sup>6</sup> fusulines about 35' below saddle just at end of easternmost knob.



12

4900

5400  
195

180  
15  
195

36  
5



(15)

*Omphalotrochus* seen in fine-grained ls on west side Kings Fault. We walked down the hill and to the west for about 0.2 mile. At top of hill from the front one can see the fine grained limestone thickening east and pinching down on to the dolomite. just under the saddle on the W side Kings fault most of the slope is in dolomite. The limestone of E facies type, which here is quite massive. This seems to finger into the dolomites. The dolomite I should call W facies, because it is granular and often crinoidal.

M187 *Fusulina* on slopes at about 4900'

Above the *Fusulina* came 130' of dolomite which was followed by 65' of fine grained massive limestone which forms the crest of the Knob. The limestone thins out on the dolomite about 0.1 mile W of easternmost knob.

M189 *Leaechinella* in undolomitized bioherm.

M1810 - *Leaechinella* in dolomite 70' below top of westernmost knob on N side of hill. The north dip slope is all in lower Hess and the top of the knob is low Hess. Silicified *Rhipidomella hesleri* seen in dolomite on top of Knob. Fragment of *Seyella* with big crinoid stems seen.



(16)

In the hill N of The Hess house the entire south front of the hill must be Wolfcamp, the dolomite as well as the limestone. We find the *Brachinella* beds climb the north slope of hill with contour 5250 and forming the west knob. The whole back slope, north slope of the hill is dolomite but patches of limestone contain fossils. The loc. M183 is undoubtedly low in the basal Hess and should place the contact of Hess and Wolfcamp at the thinner-bedded limestones on the S side at the very top of the knob. *Geyerella* and *Brachinella* occur in the dolomite. Enormous crinoid stems appear in some of the dolomite and are reminiscent of the Hess ledge.

The dolomite in the Three Knobs from the west is clearly massive and derived from biohermal ls as the Wolfcamp would be. The limestone that appears at the edge of the bluff at about M185 appears as a wedge and thickens eastward and can be followed through King fault, for which we saw little evidence. This limestone was unlike that to the west where limestone appears but is massive and quite finely granular and of a light buff when weathered. This thus appears to wedge between the Wolfcamp and the Hess ledge.



(17)

May 19.

West side Leonard Mtn. section up NW knob. Start on a 5-foot layer of coarse granular massive limestone (N56° E 11° N).

- ✓ 0-3 HL M 19' small bioherm with *Stenoscisma* and *Ectolites*. This is 16' above massive ledge.
- ✓ 3-7 HL Large biohermal with abundant *Leachinella*.
- ✓ 7-17 Covered
- ✓ 17-18 Coarsely granular ls with fusulines = M 192
- ✓ 18-22 Very massive ls, with much ls conglomerate.
- ✓ 22-25 Mostly covered but slope with thin-bedded 6" to 1' slabs of dark coarsely granular limestone.
- ✓ 25-27 The bedded limestone changing to coarse granular calcarenite, the heavy bed ending in the first 2' of 28
- 2<sup>7</sup>/<sub>8</sub> - 29 covered, probably platy dark gray ls.
- 29-44 - Partially covered but mostly in coarse calcarenite in heavy beds
- 44-49 Thin-bedded limestone bands separated by thin yellowish sandy shale beds.
- 49-61 Mostly biohermal & calcarenite limestone. At 61 HL comes a bluff of cgl. limestone and biohermal, makes a low cliff. At 59 is a thick (1') layer of pinkish brown clst.
- ☆ 61-64 Limestone cgl, but with scattered pebbles of other types. *Spyridiophora* seen at 65 HL.



435  
416  
5010  
525  
504  
5

$$\begin{array}{r} 1 \\ 93 \\ 5 \\ \hline 465 \\ 39 \\ \hline 504 \\ 5 \end{array}$$

$$\begin{array}{r} 5250 \\ 504 \\ \hline 4746 \end{array}$$



$$\begin{array}{r} 5250 \\ 509 \\ \hline 4741 \end{array}$$

$$\begin{array}{r} 94 \\ 5 \\ \hline 470 \\ 39 \\ \hline 509 \end{array}$$

(18)

- 64-69 Top of ls cgl and coarse calcarenite. The top of this ledge forms a prominent bench on the side of the Mtn.
- 69-76 Shaly rock with many blocks ~~ls~~ dark thick bedded with ss skins on top. Strike  $N 5^{\circ} E 15^{\circ} W. = N 27^{\circ} E$
- 76-86 Blocky, thick bedded limestone, beds 1'-3' thick with skin of ss or silica on top, coarsely granular
- 86-94 Light gray-weathering massive limestone forming top of knob.  
This puts the Scacchinella bed 509 feet below. This knob is at about 4741'. The limestone forming the crest of this knob appears to be the one forming the main upper ls ledge of the Mtn. Looking SE it forms a prominent nose at A where it seems to be very thick. This is the same ledge as forms the long dip slope on the spurs extending N from the second high peak.  
Scacchinella bed is 5450' W of small isolated igneous hill N of down Mtn. The bed is about 75' above level of this knob.

Section on south side Arroyo - 550' W from igneous knob and about the same level. Here shales are overlain by 6' of cgl. The shale must be all of 020' type. Pebbles in cgl of all kinds & very concentrated on top.



(19)

Fossils from cgl = M193.

The cgl is followed by 20' of shale. The slope is actually covered but much shale appears in the slope.

This shale is followed by 38 feet of massive biohermal limestone. This is the first or lowest massive ledge just S of the gully. It is just on the 4750 contour. M194 are fossils from this top ledge.

This ledge is followed by 15'-25' of mostly covered but of some

slabby ls. This is followed by thin biohermal material with *Scacchinella* and large *Heliospongia* very abundant. *Scacchinella* here is at about 4775' and just outside of gully.

M195 is *Scacchinella* bed on S side gully. The first locality is about 0.1 mile N and at 4741'.

M196 - *Scacchinella* from about 4800' 0.1 mile east of gully.

Just N of the nose of the hill and about 50' above *Scacchinella* comes a thick band of dolomite.

On nose of Mtn 560 W of isolated igneous mass N 20 E of plug in valley the *Scacchinella* are at about 4925'-4950' at M196.

Here

H

S

S

S

*Scacchinella*

+ spage

10-40'

or more

slabby

ls.

15-25'

massive

ls.

38'

11000'

with

shale

20'

cgl

ss.

6'

ls.

20'

covered



(20)

Observations on Leonard Mountain west side.

The locality M19 of *Leacchimella* at about 4741 is evidently just above King's locality 77 which is the lowest exposure of Wolfcamp fusulines.

I am not absolutely certain of the contact of Kees and Wolfcamp below the *Leacchimella* but think it is on top of the lower massive bed.

The *Leacchimella* undoubtedly has some range of thickness perhaps 20 or more feet. It occurs with the sponges and also above them. The biohermal masses seem to swell and thin.

Note on compass readings prior to May 19 and for last year. Compasses were set wrong for declination. All sights prior to May 20 were taken with compasses set  $11^{\circ}$  to left of N but should have been set  $11^{\circ}$  to right of north.



(21)

May 20

King's locality 123 is  $N 24^{\circ} E$  of small igneous knob just N of Chron Mtn. Here on a small knoll are crumbly ls going to pieces and with shale underneath. Present are large productids and *Megusia Perrinites*, is present in small yellow clay concretions. This level strongly reminds me of the abundantly fossiliferous beds at Clay slide.

M 20' Knob of limestone which seems to be definitely the very top of the Hess. On yellow shaly beds just NW of this knob I saw *Clusitella*. This would correspond to beds on top of Leonard Mtn where *Clusitella* was seen just above the Hess.

On the hill due N of this knob 2 levels of ls appear, the lower discontinuous and possibly reefy masses. Dick saw *Crinophora* in the float along the base of the big hill near M 20 = King 123.

On hill M 20' I saw *Clusitella* and *Uncinuloides* in the rock. It is just possible therefore that Leonard ls #2 also joins the Hess. This would also tie in with the back slope of Windmill Hill where we found *Uncinuloides*.



125

# Word #3 Section in hill 5779

81  
5  
405  
384  
439  
314

Shale  
314

5650  
439  
5161  
150  
5061

52 11

15'

Lower Word fusulines

ls.

24'

yellow sh.

40'

Coscinophora

32'

shale + thin ls.

150

11'

flat beds of ls.

30

200

Richmond ls.

5261'

90

40'

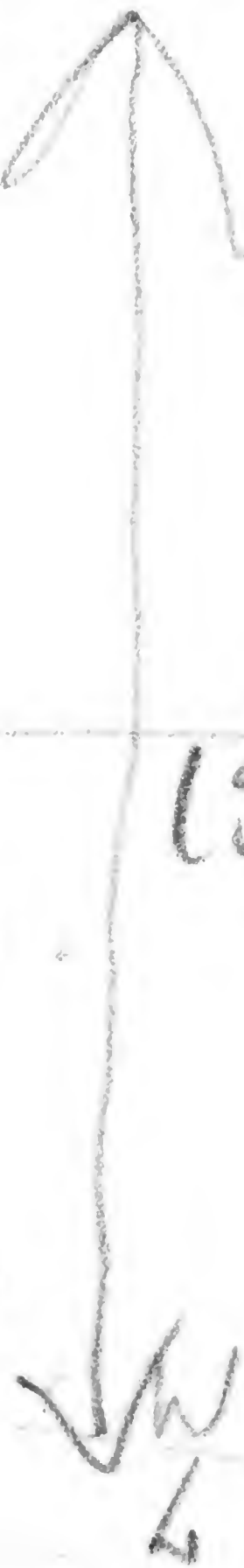
Covered

8-10'

slabby ls.

40'

shale = 4971'





(22)

M20<sup>2-4</sup> Hillside due N of isolated small plug. In lower part of section comes about 40' of shale with *Composita* and large *productids*. This is followed by 8-10' of stably ls. Above this the slope is covered for about 40' vertical when biohermal limestone appears. Loose on this slope is seen light yellow gray-weathering ls. with *Coscinophora*. The bioherms have finger-like *favosites* and sponges and suggest Leonard. Leonard-type shale appears between the bioherms and for 30' more to the base of a thick ls. ledge.

This ledge is about 11' thick, flat in beds 1 1/2' thick with silicious rings, knots and shadows of pebbles.

Above this are 32' of shale & this ls like Leonard with silicious skin.

The 32' of shale are followed by a massive ledge of ls. showing no bedding about 40' thick and with occasional scattered *Coscinophora*. The rock looks like that on the Clay Slide.

On the 40' ledge are 24' yellow platy shale followed by 15' of limestone but in the lower part are some 4 or 5' of shale. This rock is fine grained dark gray and unlike the Leonard calcarenite below. M20<sup>3</sup> is found from a bed 7' above the 15' ls.

Above this is shale, platy, yellow, in thin sheets for 5' 8" band level steps. Above this comes dark blocky smooth weathering ls. That

7115



$$\begin{array}{r} 5900 \\ 251 \\ \hline 6151 \end{array}$$

$$\begin{array}{r} 58 \\ 5 \\ \hline 63 \end{array}$$

$$\begin{array}{r} 521 \\ 818 \\ \hline 1339 \\ 34 \\ \hline 1373 \end{array}$$



(23)

becomes heavier bedded higher and strongly sandy. This is undoubtedly the Word #3 of King. This extends to top of mountain which I reached at (B) hand level steps above the 15' limestone.

The massive sandy ls forms only about the uppermost 10-15'.

M20<sup>5</sup> Fusulines 25' below top of shale or about 150' below top of hill = 5550'

M20<sup>6</sup> top of 40 foot limestone

M20<sup>7</sup> = About 40' below 40' ls.

All the rock below the 40' ledge and above the bioherms is suggestive of Word #1, somewhat platy and dark colored.

M20<sup>8</sup> - location to be plotted

Sight from WC or Captank on W side Bernard Mtn.

from Mtn house 560°W

Plug 586°W

Cgl was 125' below fusulines. Collected. Leachinella bed just above lowest big ledge runs into big dolomite mass on SE nose.



(24)

In looking at Leonard Mtn from the west side the lowest ledge of limestone that is at all prominent is the layer just under *Scaphiumella*. On the north side of the last ravine near the northwest spur of the Mtn this limestone appears as a low ridge. On the south side of the ravine this ledge is thicker but broken slightly in two places causing a discontinuity. It can then be followed unbroken until it merges into the thick dolomite on the Southeast front of the Mtn.

At 1720<sup>8</sup> we climbed up the side of the mountain which was covered for fully half the distance. The first rock seen was ss and conglomerate followed by a covered interval and then thin and thick bedded limestone crowded with small fusulines which strongly suggested Gaptank to me. It might however be Wolfcamp. The fusulines collected came 125' above the cgl. From the base of the Mtn. massive limestones appear under the cgl. and some of the limestones appear to pass into dolomite.

Thick layers of dolomite are interbedded with limestone and limestones pass into dolomite. The dolomite is thus not a depositional feature.

The upper Leonard shales are of considerable interest. They contain thin-bedded calcarenites. On walking from Knob 1720' to King's locality 123 we crossed several low hills held up by limestone layers or lenses surrounded by yellow "shale" chert or thin bedded ss.



(25)

Section M20<sup>2-7</sup> shows at least 50' of upper Leonard shale followed by biohermal beds containing favosites, sponges and other Leonard fossils. These are followed by somewhat platy or blocky dark gray ls weathering light gray somewhat suggestive of Lower Word on Sullivan Peak.

The 40' massive limestone ledge contains *Coscinophora* and is probably the same as our M15<sup>4</sup>, but whether or not this is really ls. #1 of The Word is another matter. It certainly is faunally unlike the material collected at 706f. I suspect that 2 limestones have been mapped as one and that the *Coscinophora* limestones are the lower of the two.



(26)

May 21  
Hill West of Iron Mtn.

- At base mealy rock crumbling into small lumps followed by fairly massive limestone. The rock is made up of fossil debris with broken *Sinopora* abundant. This suggests Pennsylvanian. The 15' of rock here are about 100' below the base of the cgl forming the main cliff. Section begins with cgl but I don't know the base of it.
- 0-4 coarse cgl. with numerous pebbles up to several inches in size.
- 4-8 Mostly coarse somewhat flat bedded calcarenite. Some algal ls at top.
- 8-10 Irregular somewhat broken up ls.
- 10-12 Thin bedded very fine-grained and darker gray ls.
- 12-52 Enormous crinoid stems at 16. 1421' = fusulines and *Schubertella* found at 24 Hk. All the way up the hill the rock is massive, mostly calcarenite but with broken up limestone. Saw very few fossils. Top of knob is conglomeratic with scattered small pebbles. Saw *Spindophora* in ls. on top. Pebbles up to 1 1/4".



(27)

= M21<sup>2</sup>

On west side of a small fault is top of Hess, and above it are 10-15 feet of yellow shale followed by a bed about 2' thick of gray sandy limestone. This upper bed has *Uncinuloides* and *Epyridiophora*. The top of the Hess is quite sandy and has *Eufolites* and *Euroscisma*. This all looks like base of Leonard at Split Tank. Saw no *Institella*.

Location of shale N47E to volcanic plug. N20°E to Hess hill. This patch is wavy in thin-bedded as with no real shale.

M21<sup>3</sup> - north end of hill low and all dolomitized.

M21<sup>4</sup> - East face of knob at N end hill W of Cron mts. 175' above floor is lowest rock exposed which is massive granular ls. of the Hess type.

M21<sup>6</sup> = King's loc 120. Here are *elstitella* and covered *Richtofenia*

M21<sup>7</sup> Split tank under Hess



(28)

Section in saddle M21<sup>5</sup>Fault on west side draw runs  
N 60° W

25' Hess lithology

10' (approximately) coarse sgl. with *Scaevola*  
*formosa* ledge. This bed is about  
25' below the saddle.

65' covered

covered  
32' Massive biohermal limestone with large  
corals at base. Probably *Septantia*Corals = M21<sup>8</sup>.Thin as  
like  
"shale"  
white to yellow



(29)

Hess cgl. on NW side of ravine is only about 10' thick and seems to overlie Gaptank and the sandy shale. The yellow beds seem to belong to the Hess.

Up steep slopes of mountain W of Lion Mtn. in morning. Saw about 20' of coarse cgl. forming lower beds of the main bluff. Cgl. masses lower down appeared not to be in place. Never did see a contact with underlying beds. After reaching top of hill (3250) we went down spur to the NW to King's locality 3 (my M 21<sup>2</sup>). Here we saw *Uncinuloides* but I did not see *clausitella*. We then went NE through ravine at N end and circled back to starting point.

Hills at N end are completely dolomitized. They were not however recognized as Fast Facies of Hess. On returning to car crossed patch of "shale" near north end. This is really not shale but is light, fine-grained, thin-bedded sandstone. We saw no fossils and all loose blocks on its surface were float. It occurs not far below the Hess but here no conglomerate is exposed.

After lunch went to north end of hill to study knob and saddle. Base of hill is mapped as Gaptank but the east side is mostly mantled by slide from above. The main cliff comes about 175' above the desert floor and is a massive bihermal limestone overlain by a bluff of Hess to the top of the hill about 200 feet.



(30)

The most interesting part of this mountain is in the saddle connecting the knob to the main mass of the hill. On the SSE side of the knob at its base is dark biohermal limestone with large corals. Above this is an interval recorded as covered but actually it is occupied in part by nearly vertical Hess limestone which must have slid from above. The covered interval is followed by cgl probably less than 10' thick but shedding blocks over the surface for fully 15'. In this cgl. we found gigantic fusulines. The cgl. is about 25' below the crest of the saddle. The cgl. is followed by a considerable thickness of Hess. Hess cgl. again appears on the crest of the saddle. The whole block of Hess cgl. and overlying Hess has an irregular dip and appears to be a slipped block tilted over and permitting the cgl. to appear on both sides of the block. The small ravine or reentrant opposite main part of saddle shows the Hess cgl. on the south side of the saddle and forming a rim around the amphitheater. The cgl. butts into Hess on the west side of the Amphitheater where there is a fault. The floor of the amphitheater has biohermal Gaptank and the white sandy chips like those seen before locally and which also appear about 100' above desert floor on east side of Knob. The yellow beds seen before (1951) definitely appear above the cgl. and are Hess. The cgl. must be covered under the Knob and must lie directly on Gaptank. There is hardly room for any Wolfcamp in this hill.



(31)

May 22

Strike on Hess cgl  $N55^{\circ}E$   $12^{\circ}W$ On the underlying rocks  $S70^{\circ}E$   $10^{\circ}N$ .

On this knob cherts, ss. and limestone of Pennsylvanian are overlain by Hess. On the SE slope of the hill W  $53^{\circ}W$  of Sullivan Peak with covered interval of about 10' comes following section:

M22 - Lower Hess top of knob.

Massive biohermal limestone 40'

Platy ss with silicious skin 10'

Massive limestone, some cgl. 8'

Covered 15' /

Hess

cgl. coarse 5'

Penn.

On south side of hill ( $N10^{\circ}E$ ) from center of knob and facing Marathon the cgl. is full of WC fusulines especially at base. Under cgl we saw yellow platy beds with WC fusulines.

On east side of hill cgl. wedge in at different levels. Some with enormous crinoid stems ( $2\frac{1}{2}$ " diameter). These are evidently channels and appear also well up in the Hess.

M22<sup>5</sup> - fusulines from base at knob M22M22<sup>6</sup> fusulines from WC conglomerate at M22.



(32)

M22<sup>1</sup> - hill just west of clay slide here are 50-60' platy, gray limestone weathering into flat slabs and straining the surface. M22<sup>1</sup> are fusulines from east side of hill near saddle. Fossils are scattered and are mostly isolated brachiopods. Occasional thick beds of ls. occur. Saw no *Coscinochona*. Contains big *Productids*. M22<sup>2</sup> On higher westernmost hill are about 100' of thin slabby ls. but in midst of it and forming very back of hill is massive siliceous ls. The platy beds run right into this heavily bedded limestone. No *Coscinochona* seen. Thick lenses of chert are common at both M22<sup>1</sup> + 22<sup>2</sup>. To the W toward Sullivan Peaks Tan beds can be seen lying on the thick limestone that produces *Coscinochona*. That must be a reefy mass in the Lower Word. These thin beds lie on the thick limestone at the east end of the hill.

M22<sup>3</sup> - Hump of massive gray ls. On west end of M22<sup>1</sup> next to ravine we have massive ls which is definitely overturned by the platy beds.

M22<sup>4</sup> - went over to east end of *Coscinochona* hill. Here the bituminous platy ls with its lenses of chert overlies the massive ledge with *Coscinochona*. This is therefore all Word (Lower). Saw big *Prod. bassii*.

M22<sup>7</sup> - Leonard base of clay slide



(33)

M22 - Knob east of Windmill hill shows Pennsylvanian with strike and dip different from that of the main mass of the knob. On a 5-10' covered interval were seen 5' of coarse cgl. with WC fusulines at the base and well up in the cgl. The fusulines are also at the base of the cgl in yellow brown thin-bedded ls typical of some types of WC. On south side of knob cgl is only 5' thick and is succeeded by Hess type rock which runs to the top of the hill.

On the east side of the hill cgl appears at several levels but seems to be Hess. The Wolfcamp part seems to be covered. The cgl appears as lenses and often associated with bryozoans containing the peculiar geometrical bryozoans. I think all on this side is Hess.

On the north side of the <sup>hill</sup> is a long dip slope of Hess showing prominent patches of cgl. On this slope of fossil good *Sayella*, an indication of Hess.

On the east slope *Coscinopora* and another Hess type was found.

M228 - This is King's locality from. The whole hill is in granular Hess with some bryozoans and patches or lenses of cgl. in the lower half.



(34)

May 23

Wolf Camp Hills - First went to see section not far west of ravine that runs North. Bed 9 (= 12 of King) appears in the bed of the arroyo at the forks. I measured my section from this point with a dip of  $11^{\circ}$  N  $16^{\circ}$  E  $10^{\circ}$  W. The shales are blue gray and the limestones all yellow to brown. Crinoid stems are large but seldom as large as in the Hess.

After studying section went and hunted for ammonites on top of bed 2. Found a few specimens but none of real quality. = M234

Afternoon collected one block from M23 and 3 blocks from M23'.



(35)

Section along stream N of elbow to N+W.  
Actual measure

Here conglomerate

X	20'	shale	
W	6"	ls	
V	2'	shale	
U	1'	ls - fusulines	$M 23^3 = 712y$
T	32'	shale	
S	4'	biohermal ls.	
R	11'	shale	
Q	2'	ls	
P	22'	shale	
O	6"	ls	
N	5'	shale	
M	2'	ls	
L	24'	shale	
K	1'	ls - collected fusulines	$M 23^2 = 712x$
J	5'	shale = Eng 1951	
I	6"	ls	
H	4'	shale	
G	2'	limestone thickens eastward	
F	8'	shale - some cobbly material sheds onto D.	
E	2'-6'	limestone	
D.	17'	shale - upper part cobbly with <i>Properinites</i>	
C.	5'	limestone	$712z \text{ collection} = M 23^5$
B.	42'	shale	
A	5'	Bed 9 of Cooper = bed 12 of King	

Total 212'  
above bed 9

216  
47  
169

147



(36)

covered between

Hess cgl. +

base of section May 24

Up front at east end WC hills

Hand levelling

started at  
4750'On first 100' The lower 5' consist of  
thick heavy-bedded limestone, light  
yellow gray in color.

5'-100' covered.

M24<sup>1</sup>  
716a

Crassitectonia

100'-165' Moderately thick bedded dolomite,  
beds 6" to 1' thick. At top is a layer  
of fusulines (M24<sup>1</sup>) moderately light  
gray limestoneM24<sup>2</sup>  
716b

Crassitectonia

165'-190' - same dolomite. at 190'  
comes a one foot layer almost  
completely composed of fusulines.  
Another fusuline bed about 4'  
above the other, but this bed is  
mostly dolomite and the fusulines all  
crumbly.M24<sup>3</sup>  
716c200'-222' - fusulines in dolomite =  
M24<sup>3</sup>. Dolomite in thick beds.M24<sup>4</sup>  
716d

Crassitectonia

222'-237' - limy bed with fusulines  
in dolomite. M24<sup>4</sup>237'-250' some dolomite in layers 2'  
thick.M24<sup>5</sup>  
716e250'-255' at top a 2' layer of  
calcareous = west facies of Hess.  
2 pieces taken M24<sup>5</sup>.  
Crassitectonia



(37)

255-288' - Heavy-bedded dolomite with silica.

288-300' - same dolomite but a thick bed of 3' at top.

300'-310' massive pitted dolomite, light brown.

310-350' Thinner-bedded lighter gray dolomite.

350-361' Thin-bedded dolomite. 359'-361' comes a massive bed almost made up of fusulines. M246. Also colonial corals.

M246  
716f  
Pseudofusulina

350'-395' Thin-bedded dolomite

395'-400' One massive ledge in 3 layers the top one 1', 3' and 1'.

M247  
716g

400'-438' - Thin-bedded dolomite on long tongue of Mtn. N 34 E of Uddenites knob.

438'-450' - same dolomite, much fractured

450'-500' - dolomite in beds 6"-1' thick occasional ones thicker.

500-550' same dolomite but somewhat heavier bedded than below. N 59° E 80° NW.

550'-600' Heavy-bedded dolomite

600'-645' mostly moderately bedded dolomite but with 3' brown band on top.



(38)

M 249

716 h

645'-650' thin-bedded dolomite.  
Top 2' in massive smooth  
limestones abounding in fossils.

650'-675' thin & thick-bedded  
dolomite, the top ledge 3' thick

675'-700' same with 3' ledge 8' below  
top.

700'-735' - dolomite and smooth ls.  
moderately thick-bedded.

700'-773' - massive, heavy-bedded  
pitted dolomite.

773'-800' about 3' below top a nearly  
bed with pectenoids. otherwise moderately  
bedded dolomite *Bigonopholotrichus*. This is  
about the level of the fossil bed?

Fossil  
bed at  
5547'

800'-860' Thick-bedded dolomite (2')  
alternating with thin-bedded dolomite  
and limestone. N 53° E 9° NW.

860'-880' Shaly bed at very base  
with echinoid plates and spines. Green  
shale near top; 10' yellowish echinoid  
spines & plates.

880'-888' platy limestone in a thick  
ledge

888'-890' pitted dolomite forms top  
of hill at M 249.

Hand levelled down slope to west  
about 0.2 mile to east side big  
amphitheater. Went down 25'. Hand-level  
starts at about same level as on  
top of hill at long section but at  
863'



(29)

863' - 944' from top of dolomite on  
end of section to top of massive  
dolomite that forms a thick, high  
cliff opposite the Wolfcamp hills.  
The lower 30' of this interval are  
covered

944' - 994' - Light colored somewhat  
platy dolomite. Thick bedded in last 8'

M 24<sup>10</sup> 994' - 1038' brings me to crest of hill  
all through yellow brown dull pitted  
dolomite

4750 starting level.

1038

5788' hand level, top of hill at 5785'



44 12  
103 13



(40)

May 24 "

Hill east of Wolf Camp Hills

0-10' Covered

10'-44' Dark gray biohermal limestone with  
 fritos. *Hypelalgae*, *Regulifemina*, *buozoa*  
*Hystericulina*. Rock very irregular and  
 crumbles to big cobbles.

44'-147' Soft gray shale mostly forming  
 a covered slope with much slide from  
 above. *Spiratites* = 1724'14" = 716'4"  
 147'-151' Yellow brown ls. with fritosalgae and  
 other fossils. *Fusulina* at top = 1724'12" = 716'2"

151'-162' Sandy shale mostly covered.

{ 162'-181' blocky sandstone with reddish brown  
 band 13' thick at top.

{ 181'-192' Same gray ss.

192'-197' Dark gray smooth-weathering ls. }  
 197'-201' Coarse granular ls }

201'-203' light gray ss. }

203'-210' Sandy limestone }

210'-226' Covered saw some crumbly yellow  
 shale in float.

226'-226' Massive ledge of smooth gray  
 limestone forming the sharp  
 scarp of the hill.



(41)

276'-298' - About 22' of light gray granular limestone. *Strophomena* large in float

We walked the entire dip slope of this hill from the crest to the point where the road along the base of the high hill runs. On the north side of the road is a low gravel bank not over 25' high. A ravine in the east side of this bank reveals red and light gray shale. Above this comes the characteristic dolomite of the Hess.

The sloping limestone of the hill changes from ls to dolomite several times to the place where it plunges under the Hess.

M24<sup>13</sup> - Same limestone as forms top of hill M24<sup>11</sup>.

Failed to find fossil bed where section of M24 was made, but I think the beds from the place where *Ornithotrochus* was seen through the shale with columnar fragments is the level of King's fossil bed.

Saw no Hess conglomerate on the dip slope of hills M24<sup>11</sup> and M24<sup>13</sup>, although they are mapped there. I think the entire hill M24<sup>11</sup> is Gaptank.

716K = M24<sup>15</sup> is a loose piece from top of hill M24<sup>11</sup>.



196

0530

(42)

May 25

Ranch on W & Hills is called  
 "Bill Neal Ranch." Total section  
 N60°E 9°NW.

Hill is 100'

Section on 701d

cont'd over

2'	ls. granular
2'	shale
1'	ls. granular
3'	shale
6"	capping ledge for dip slope
10' +	Shale - long dip slope with brokenness
6"	flat platy ls. This is uppermost ledge. <span style="float: right;">Top of hill</span>
5'	shale 5'
1'	limestone, thick flat plates
7'	shale
2'	ls.
3'	shale
1'	hard granular ls. 2'
8'	shale
8'	granular hard ls., broken in lower half.
13'	shale
3'	ls, cobbly at base, hard granular above
22'	shale
3'	ledge of massive granular ls. (M25') = 716-l Blocks from this interval just under main ledge.
60'	mostly covered, probably shale
25'	Shale with thin limestones (3)
2'	granular ls. fragments
5'	covered
3'	out in plain 50 yards S of hill, hard granular



(43)

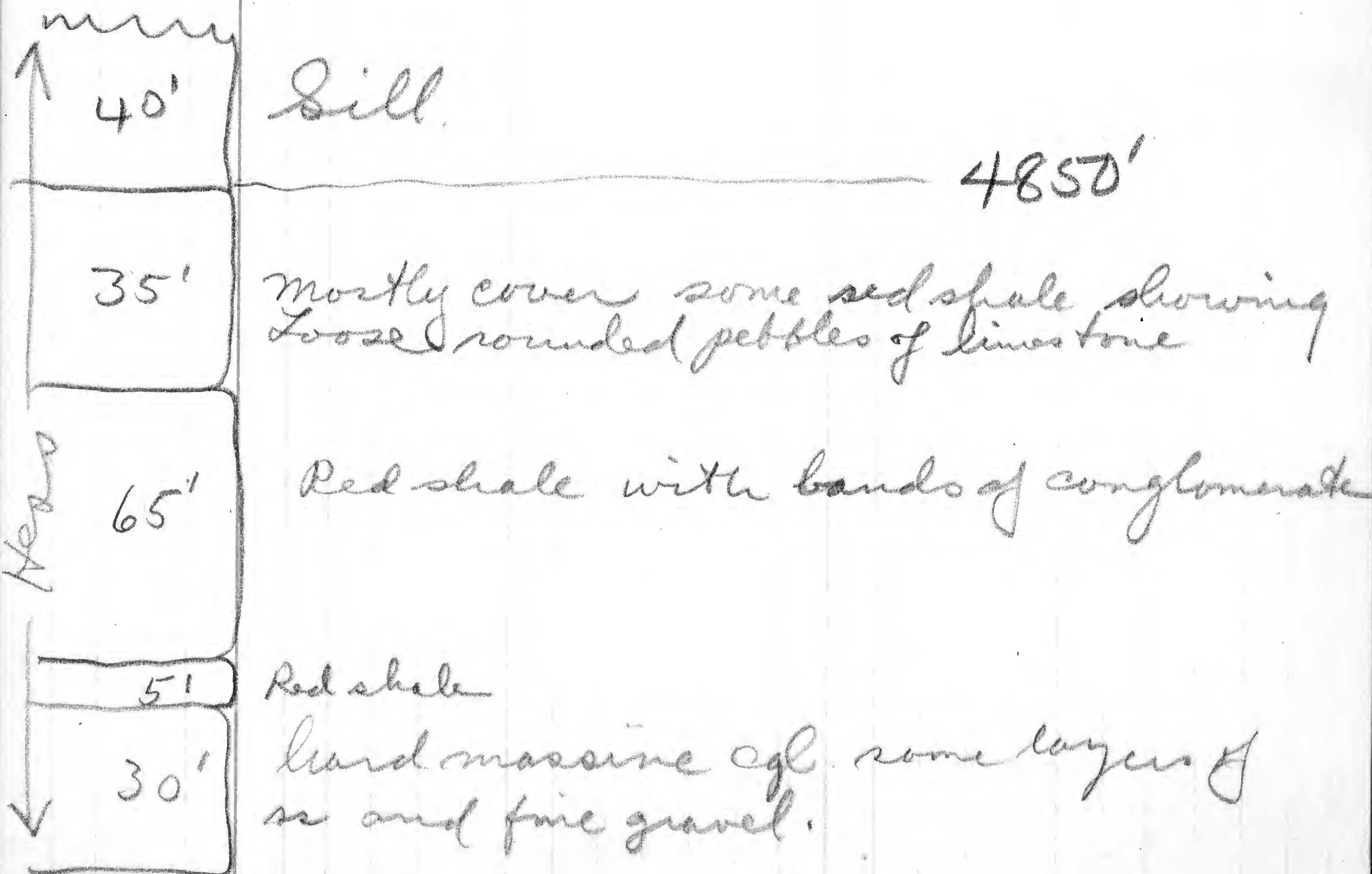
Over for continuation  
massive cgl.

5'	shale light gray
3'	ss with 6" hard platy ss on top
35'	shale & shaly ss, mostly covered
3'	brown (yellow) sandstone.
65'	Partly covered but revealing some shale
6"	brown calc. ss.
23'	Covered slope
6"	congl. ls.
15'	Covered slope with thin brown ls.
1'	ls
shale	20'
1'	ls with 3 one-foot beds of ls. This is at base of mountain
20'	shale
4'	brown ls.
16'	shale
2'	ls granular - Fusulines $1725^2 = 716m$
5'	shale
15"	ls in 2 layers
10'	shale with 4" ls in middle
1'	ls.
6'	shale with 2 ls. ledges 2' apart Fossil wood
9"	ls.
2'	shale



(44)

Collected in my bed D of May 23.  
 Dick found a fine *Artinskia*.  
 This gives two zones of *Artinskia*  
 in the Wolfcamp Hills, which may  
 correspond to zones in the western  
 part of the hills.





(45)

May 26.

Send pictures to Leonard Hess.

Went to Split Rock. Took all morning to get good block at 702m. Late afternoon went to hill N of Hess house to collect slope of hill facing north.

Check location of 517<sup>3</sup> in 1957 notes. Check direction from hill.

Fluorite 45 miles S of Boquillas, Mex.

May 27.

Fossil bed in King's 212 has a limestone cal. beneath and a hard yellowish ls. with brown chert above it.

Fossil bed 180' below middle knob or at 5570-5580' on nose of hill. Middle knob is 5750' or 5760'.

The hard yellowish limestone with the chert contains large Corypholothodus fairly common. The rock containing the fossils is a cobbly limestone with the cobbles separated by gray shale. In places the bed contains considerable shale. The position of the fossil bed is about 100' below a conspicuous thick dolomite bed that extends from the saddle between the knob and hill 5821'. This dolomite extends eastward and reaches the edge of mountain front on the east end of hill 5785. Small faults make it difficult to follow the fossil bed continuously.



May 28

(46)

Collected 3 blocks at M28-W4  
 " " " " 706e.

M28<sup>1</sup> - Small knob - 50' below top, on south side, is a large bioherm of *Scacchiella* which is overlain by coarsely granular lites. At the top of the knob, about 5' below the crest, is a coarsely granular ls. with Martiniid-like shells, very large *Genssina*. This is like the small knob on west side Iron Mtn., Leonard Mtn. and N of Hess Ranch.

716g M28<sup>2</sup> - *Scacchiella* bioherm at base of hill, another east of this one. Many angular bryozoans forming a network, like the ones seen on knob on Iron Mtn. Ranch. *Heliospongia* very common. *Seydella*, large *Meekella*.

M28<sup>3</sup> - About 10' yellow brown thick bedded fine-grained calcarenite overlying 10' or more of shaly and blocky yellow Wolfcamp rock. A few fossils on shaly slope. This is due west of low knob in saddle on Hess Ranch Horst. The knob shows light colored Hess calcarenite forming a long dip slope perhaps 40' of rock which underlies the *Scacchiella* beds of M28<sup>2</sup>. The Hess seems thus to thicken somewhat under the *Scacchiella*. The NC forms dip slope for a short distance where lighter colored Hess calcarenite overlies it.



(47)

M28<sup>4</sup> = King 105 This is a *Saccinella* and *Bygonia* bioherm about the same M28<sup>2</sup>, and about same level. *Heliospongia* abundant. Much silicified algae.

M28<sup>5</sup> *Saccinella* reef. Others on same hill. Underneath these reefs comes crinoidal, sandy ls. with silicious skin on upper surface abounding in crushed fossils including *Altiplexus*, *Stenocrinus*, large *Murchella*, *Composita*, *Derbyia* and others. *Trigona*, *Heliospongia* are also present. L.H.R.

M28<sup>6</sup> - Back slope of Wolfcamp limestone from loc. M28<sup>3</sup>.

The small knob in the notch between the two hills of the horst is capped by light colored limestone looking like the Hess of Leonard Mtn. This limestone definitely includes the *Saccinella* reefs of the lower Hess. Estimated that there must be 40 feet of this limestone. It is thus suggestive that Hess is intertongued between the Wolfcamp and the *Saccinella* beds. Perhaps the Horst gives definite proof of this.

The *Saccinella* beds are generally underlain by beds of dark gray detrital limestone often dipping into the bioherm. These contain a variety of fossils, usually crushed.



(48)

May 29.

Morning went to Word #4 area north of old Word Ranch. Found good collecting area on long nose of hill. Apparently not same place as S 17<sup>3</sup> which must be relocated from last years 1957 notes. 1129 contained same material as S 17<sup>3</sup>, including numerous richthofeniids and Aulosteges tuberculatus. I think this is approximately same locality as S 17<sup>3</sup>.



(49)

May 30  
M30 = fusulites

M30' = Section on slope of hill

Word  
shaleN30° E of hill N of Hess house; N10 E of  
Knob on E side Leonard mtn; N70° W of hill 5726

30'

Hard mass ls with *Coscinophora*, cup  
corals and sponges (finger).

15'

mostly covered but with lumpy light  
blue gray ls.

25'

Gray (light) weathering calcarenite  
with brown skins, beds 1-3' thick

42'

Solid ledge of massive ls abounding  
in finger sponges, corals (long cup) and  
*Coscinophora*

5'

ls. congl. rounded pebbles.

covered

The beds with *Coscinophora* are  
exactly like those on west  
side Sun mtn. Ranch. The  
*Coscinophora*-sponge masses  
are reefs in the lower word.



120  
110

525  
260  
221  
281  
130  
155

2000

287

278

Mar. 1891  
Maine  
Rancho de la...

12



0538

Beck

M1- - - - - 3 114w

M154

707e - 2

M196, — — — — — 2

44-38861-1000

1/23

17231 - - - - - 3

70/d - - - - - 4

702 44

706e -

1728

702C

M301

40



HR 21310  
 State Rd 21316.8  
 Hotel 21324.5

1026  
 3591.0  
 5130  
 3078  
 3591.0  
 3591.0  
 3591.0  
 4941  
 5025  
 4941  
 134



5800  
 410  
 4890  
 5025  
 4870  
 125  
 4104  
 1026



